

Readmission Rates at Lexington Hospital for 43,215 Narcotic Drug Addicts

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A STUDY of rates of readmission of patients to the Public Health Service Hospital, Lexington, Ky., during a 32-year period was undertaken to analyze the association of specific demographic and treatment variables with repeated hospitalization of opiate addiction. In the present context, rates of readmission are seen as providing an index of relapse within the various patient populations and a means of assessing the efficacy of treatment.

The first addicts were admitted to the hospital at Lexington on May 28, 1935 (1). From that date to the end of 1966, 43,215 addicts were admitted for psychiatric and medical treatment. Inasmuch as many of these patients relapsed to abuse of drugs and returned for further treatment, the recorded number of admissions to the hospital is considerably greater than the number of patients; during the 32 years there were 77,076 admissions.

Computerized Enumeration Procedure

Admission and discharge information pertaining to all addicts treated at the Lexington hospital since 1935 was retrieved and computerized. After this data bank was established (during a 3-year period), it became possible to analyze hospital and demographic variables concerning the total hospital population of 43,215 patients. Indeed, until the master file was established it was not possible even to count the number of patients admitted.

Of the 43,215 addicts hospitalized at Lexington, 70 percent were voluntary patients and

30 percent were Federal prisoners. The voluntary patients could, at their discretion, leave the institution at any time after admittance and, in fact, most did leave against medical advice (2). Notwithstanding their early discharge, many patients returned for further treatment. Thus, free and confidential treatment for drug abuse was continually available to addicts during this 32-year period (3).

In addition to the voluntary patients, Federal prisoners were also admitted to the Lexington hospital. These prisoners were serving designated sentences and were not free to leave; they could, however, be subsequently readmitted as either prisoners or voluntary patients.

Admission Trends, 1935-66

From 1935 to 1938, the Lexington hospital accepted only male patients from throughout the United States. After 1938, when a second Public Health Service Hospital was opened at Fort Worth, Tex., the Lexington hospital had the eastern part of the nation as its principal catchment area. Since July 16, 1941, female addicts from the entire United States have been admitted to the Lexington hospital. The subsequent analysis refers only to data for the Lexington hospital.

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Table 1. First admissions of addicts to Lexington, 1935-66, by sex, number, and readmissions within year cohort

Year of admission	Males admitted			Females admitted ¹			Number of admissions in year
	Number first admitted	Ever readmitted		Number first admitted	Ever readmitted		
		Number	Percent of cohort		Number	Percent of cohort	
1935.....	823	346	42.0	0	0	-----	823
1936.....	961	365	38.0	0	0	-----	1,018
1937.....	679	261	38.4	0	0	-----	831
1938.....	895	344	38.4	0	0	-----	1,144
1939.....	775	345	44.5	0	0	-----	1,013
1940.....	676	336	49.7	0	0	-----	981
1941.....	615	264	42.9	105	60	57.1	1,167
1942.....	775	337	43.5	248	118	47.6	1,668
1943.....	712	330	46.3	236	108	45.8	1,770
1944.....	637	275	43.2	174	59	33.9	1,619
1945.....	584	226	38.7	161	74	46.0	1,566
1946.....	762	306	40.2	137	67	48.9	1,856
1947.....	792	408	51.5	242	101	41.7	2,371
1948.....	832	419	50.4	188	69	36.7	2,248
1949.....	1,158	571	49.3	438	164	37.4	3,368
1950.....	1,822	750	41.2	511	185	36.2	4,016
1951.....	1,600	658	41.1	501	165	32.9	3,563
1952.....	1,348	526	39.0	517	167	32.3	4,037
1953.....	1,578	537	34.0	638	203	31.8	3,854
1954.....	1,309	469	35.8	540	169	31.3	3,155
1955.....	1,196	393	32.9	460	143	31.1	2,925
1956.....	1,281	447	34.9	494	168	34.0	3,310
1957.....	1,312	447	34.1	463	134	28.9	3,364
1958.....	1,438	481	33.4	458	117	25.5	3,575
1959.....	1,344	386	28.7	442	91	20.6	3,505
1960.....	1,574	386	24.5	484	108	22.3	3,491
1961.....	1,147	277	24.1	364	70	19.2	2,769
1962.....	1,280	277	21.6	289	39	13.5	2,883
1963.....	1,096	185	16.9	294	51	17.3	2,505
1964.....	1,111	149	13.4	266	39	14.7	2,355
1965.....	906	127	14.0	255	20	7.8	2,017
1966.....	1,025	46	4.5	267	18	6.7	2,309
Total.....	34,043	11,674	34.3	9,172	2,707	29.5	77,076

¹ First female patients accepted for treatment July 16, 1941.

The annual number of first admissions for male and female addicts is tabulated in table 1. In 1935, the first year, 823 males were admitted for treatment. This incidence of hospitalization did not increase materially until 1949; in that year, there were 1,158 first admissions of male addicts. The peak in first admissions of males occurred in 1950, when 1,822 males first came to Lexington.

The total number of annual admissions to the Lexington hospital has shown greater variation than the number of first admissions. From 1935 until the end of World War II, there were from 823 to 1,770 admissions per year (table 1). Starting in 1946, this number increased rapidly and reached a peak of 4,037 admissions in 1952. In

that year there were 1,865 first admissions and 2,172 readmissions.

The first female patients were admitted for treatment in 1941. From that year through 1966, 9,172 females were admitted to Lexington. In general, the incidence of hospitalization for females followed a similar trend to that of the males, except that the peak year was 3 years later, 1953 instead of 1950. This lag may be related to the fact that females start to use drugs at a later age.

Number of Admissions for All Patients

Before analyzing readmission rates by demographic and treatment variables, it is relevant to consider the number of hospital admissions

realized by the total patient population. Of the 43,215 addicts admitted from 1935 through 1966, 66.7 percent had a single admission, 17.3 percent had two admissions, and 16.0 percent had three or more admissions (table 2). Of the patients who had three or more admissions, 33 patients had more than 20 admissions and one voluntary patient from New York City had been admitted 39 times.

Two technical points concerning the total number of admissions are pertinent to our subsequent analysis of rates of readmission. First, in computing rates of readmission, only the second admissions are used, as all readmissions have at least a second hospital stay. Thus, each patient has either been readmitted or he has not, providing a dichotomy. The second point is that it is erroneous to use the absolute percentage figures of table 2 as rates of readmission since years at risk have not been taken into consideration.

Calculation of Readmission Rates

The number of patients admitted each year who were subsequently readmitted to the Lexington hospital is tabulated in table 1. In 1935, 823 male addicts were admitted; by the end of 1966, 346 of these former patients were readmitted. Thus, of the 1935 male cohort 42.0 percent were readmitted. The highest rate of readmission for males was obtained for the 1947 cohort; 51.5 percent returned for treatment. The highest rate for females was for the 1941 cohort; 57.1 percent returned for treatment.

The principal statistical difficulty with the

cohort approach is that it does not take into account years at risk. Thus, the lower readmission rates of those patients first admitted in the 1950's or 1960's are spurious because some of these patients could be expected to be readmitted after 1966.

To calculate years at risk, the elapsed time between first and second admissions for the 14,381 patients who had more than one hospitalization was tabulated (table 3). Almost one-quarter of those who return to the hospital do so within 1 year of discharge, and more than half return before 2 years have passed. By the end of the sixth year, 90 percent of those who will return have done so. After 15 years, only one-half of 1 percent will be readmitted.

This sequential data on admissions provide a means for calculating rates of readmission which are controlled for years at risk. A matrix of rates of readmission by years at risk was formulated and the probability of readmission statistically derived for each of several patient populations, males compared with females, or voluntary patients compared with prisoners.

More technically, a statistical method of calculating rates of readmission which controls for different years at risk was employed. This method was derived by Dorn in 1950 (4). Subsequently, Thompson and Allen (5) developed the statistical properties of this estimating scheme, including a formula for the standard deviations used in analysis of the data.

In the Thompson and Allen procedure, the probability of a second admission, which we shall call *P*, can be described as the sum of prob-

Table 2. Number of admissions for 34,043 male and 9,172 female addicts, 1935-66

Number of admissions for each patient	Number of patients			Percent of patients in admission intervals
	Male	Female	Total	
1.....	22, 369	6, 465	28, 834	66. 7
2.....	6, 028	1, 434	7, 462	17. 3
3.....	2, 452	552	3, 004	7. 0
4.....	1, 192	277	1, 469	3. 4
5-9.....	1, 609	380	1, 989	4. 6
10-19.....	362	62	424	1. 0
20-39.....	31	2	33	. 1
Total.....	34, 043	9, 172	43, 215	1 100. 0

¹ More than 100 because of rounding error.

Table 3. Number, percent, and cumulative percent of addict patients having a second admission, by sex and number of years following first discharge

Years after first discharge ¹	Males			Females		
	Number readmitted	Percent	Cumulative percent	Number readmitted	Percent	Cumulative percent
Less than 1.....	2,841	24.3	24.3	647	23.9	23.9
1.....	3,587	30.7	55.0	858	31.7	55.6
2.....	1,666	14.3	69.3	416	15.4	71.0
3.....	1,016	8.7	78.0	222	8.2	79.2
4.....	671	5.7	83.7	164	6.1	85.3
5.....	483	4.1	87.8	112	4.1	89.4
6.....	362	3.1	90.9	80	3.0	92.4
7.....	264	2.3	93.2	63	2.3	94.7
8.....	191	1.6	94.8	33	1.2	95.9
9.....	149	1.3	96.1	36	1.3	97.2
10.....	119	1.0	97.1	21	.8	98.0
11.....	78	.7	97.8	14	.5	98.5
12.....	71	.6	98.4	18	.7	99.2
13.....	55	.5	98.9	7	.3	99.5
14.....	39	.3	99.2	9	.3	99.8
15.....	23	.2	99.4	2	.1	99.9
16 or more.....	59	.5	² 100.0	5	.2	² 100.0
Total.....	11,674	² 100.0	-----	2,707	² 100.0	-----

¹ The number and percent of readmissions in the first interval, less than 1 year, are spuriously low due to the computational artifact that this first risk period was approximately 6 months rather than a year.

² Not 100 because of rounding error.

abilities of return within a specified time. If P_0 is the probability of return within a year following first discharge, P_1 is the probability of return after 1 year but before 2 years following first discharge, and P_3 and P_4 are defined similarly, then from the laws of probability we know that $P = P_0 + P_1 + P_2 + P_3 + \dots$. There are as many terms in the sum as are needed before they become negligible. Most of the contribution to P will be in the first few terms, as patients who return to the hospital are most likely to do so within a few years after their first discharge.

Readmission Rates of Males

Rates of readmission were calculated for all patients discharged from the Lexington hospital since 1935. Of the 33,479 males discharged, 22,430 were voluntary patients, and 11,049 were Federal prisoners during their first admission. The rate of readmission for the male voluntary patients was 40.0 and the rate for the male prisoners was 36.1. The voluntary patients, then, were significantly more likely to be rehospitalized (table 4).

Of the 33,479 male addicts, 19,763 were white

and 13,716 were nonwhite. The nonwhite male patients were less likely to be readmitted to the hospital than were the white patients. The rates of readmission for nonwhite males were consistently lower than the rates for white males when both age and hospital status were controlled. The rate of voluntary readmission of nonwhites was 36.7, compared with 42.1 for voluntary readmission of the white patients. Among the prisoners, the rate of readmission for nonwhite patients was 29.8, compared with a rate of 40.7 for the readmission of white patients. The nonwhite male addicts, then, were less likely than the white male addicts to have subsequent admissions.

Marked differences in rates of readmission of males were related to age at first admission. The younger patients had higher rates of admission. When years at risk were controlled, the younger patients still had significantly higher readmission rates. These higher rates of the young addict were obtained for both whites and nonwhites and for voluntary patients and prisoners (table 4). Indeed, the highest rate of readmission for males in this study (52.6) was obtained for white voluntary patients who were

20 years of age or younger at the time of their first Lexington hospitalization. This rate of 52.6 was twice that for nonwhite male prisoners aged 41 and older. Age at first admission, then, is a crucial factor in determining the likelihood of subsequent addiction and rehospitalization. The younger the addict, the more likely he is to return to the hospital.

Readmission Rates of Females

Of the 9,058 female patients discharged from the Lexington hospital through 1966, 7,419 were voluntary patients and only 1,639 were Federal prisoners. As might be expected, females were more often voluntary patients than were the

males—82 percent compared with 67 percent. Among the females, rates of readmission for the voluntary patients did not differ significantly from that of the prisoners (table 4).

The racial distribution among the female patients was similar to that noted for the males. Of the 9,058 female addicts, 6,032 were white and 3,026 were nonwhite. The lowest readmission rate for the four groups (by race and hospital status) was observed among the nonwhite female prisoners, of whom only 28.5 returned.

Although the younger females were more likely to be readmitted for treatment of their addiction than the older cohorts, age at first admission was less important among the fe-

Table 4. Probability of male and female addicts having a second admission, by age group at first discharge, type of hospitalization, and race

Age (years) at first discharge	Voluntary patients				Level of significant difference	Prisoner patients				Level of significant difference	Total patients		Level of significant difference
	White		Nonwhite			White		Nonwhite			Voluntary, probability	Prisoner, probability	
	Probability	Number	Probability	Number		Probability	Number	Probability	Number				
Total, male	0.421	13,549	0.367	8,881	0.001	0.407	6,214	0.298	4,835	0.001	0.400	0.361	0.001
20 or less	.526	700	.512	634	-----	.477	68	.407	149	-----	.524	.423	.02
21-25	.457	3,007	.406	2,874	.001	.440	602	.354	1,189	.02	.432	.391	.05
26-30	.435	1,987	.343	2,585	.001	.360	847	.291	1,327	.01	.387	.316	.001
31-40	.438	2,934	.294	2,071	.001	.434	2,068	.277	1,369	.001	.380	.375	-----
41 or older	.383	4,921	.345	717	-----	.398	2,629	.255	801	.001	.379	.365	-----
Total, female	.308	5,105	.376	2,314	.001	.379	927	.285	712	.001	.328	.340	-----
20 years or less	.383	118	.567	142	.01	.377	24	.232	26	-----	.489	.295	.02
21-25	.354	706	.425	877	.02	.376	151	.353	237	-----	.394	.364	-----
26-30	.354	750	.310	665	-----	.368	187	.247	221	.05	.336	.304	-----
31-40	.317	1,377	.320	495	-----	.404	338	.273	181	.02	.317	.354	-----
41 or older	.269	2,154	.317	135	-----	.373	227	.207	47	.05	.272	.347	.02

Table 5. Probability of male voluntary patients having a second admission, by age group at first discharge and length of hospitalization

Age group	Left against medical advice				Hospital treatment completed		Level of significant difference	
	Stayed 1-30 days		Stayed 31 or more days		Probability	Number	AMA ¹ compared with HTC ²	AMA under 30 days compared with AMA after 31 days or more
	Probability	Number	Probability	Number				
20 or less	0.612	328	0.502	417	0.479	589	0.05	0.02
21-25	.421	3,273	.472	1,336	.422	1,272	-----	.01
26-30	.402	2,749	.384	933	.350	890	-----	-----
31-40	.383	3,081	.414	1,012	.320	912	.001	-----
41 or older	.384	3,501	.381	1,301	.344	836	.05	-----
Total	.399	12,932	.423	4,999	.374	4,499	.001	.01

¹ AMA, left against medical advice.

² HTC, hospital treatment completed.

males than among the males in predicting hospital readmissions; this was especially true for the female prisoners. For the voluntary female patients, high rates of readmission were noted for those 20 years of age or younger. Indeed, the highest readmission rate for females in the study was obtained for the nonwhite voluntary patients under 21 years—56.7.

Readmission Rates of Voluntary Patients

During the 32 years, 70 percent of 43,215 opiate addicts admitted to the Lexington hospital for treatment were voluntary patients. This sizeable population of patients was freely admitted to the psychiatric hospital for treatment and then permitted to leave at any time after admittance. What happened?

Of 22,430 male voluntary patients, 12,932 stayed in the hospital from 1 to 30 days. Thus, more than half of these patients were unwilling to continue treatment for 1 month. Another 4,999 males remained under treatment for 31 days or longer, but were unwilling to continue treatment for the full period recommended by the medical staff (usually 4 months). Both of these groups of patients left the hospital voluntarily and were classified as discharged against medical advice.

One-fifth of the male voluntary patients continued their psychiatric and medical treatment for the recommended period. These patients were discharged as cured of their addiction under the classification of hospital treatment completed.

Readmission rates for all male voluntary patients discharged are shown in table 5. The data are tabulated by age and length of stay in the hospital. The variable length of stay may be considered as indicating the extent of treatment provided, inasmuch as only meager medical or psychiatric care could be given a patient who left a week or two after admittance, often before withdrawal from drugs was completed. Conversely, the patient who remained in the hospital for 4 or 6 months and was discharged as cured often received considerable psychiatric and medical treatment as well as rehabilitation services.

Although the 4,499 voluntary patients who received the most treatment and were discharged as cured had lower rates of readmission than

those who left against medical advice, the differences were small. Thus, the rate of readmission for the cured patients was 37.4, compared with 39.9 for the short period and 42.3 for the longer period of incomplete treatment. Of considerable importance is the fact that it made no difference among those who left against medical advice whether they stayed less than 31 days or more than a month; indeed, the patients remaining more than a month were more likely to be rehospitalized.

In comparing the patients who were discharged as cured with those who left against medical advice, it is pertinent that the treatment program had a significant effect upon readmissions only for those males under 21 years of age or over 30. For those voluntary patients between 21 and 30 years, length of stay at the hospital was not related to the probability of readmission.

Interpretation of Research

The study of rates of readmission is but one aspect of our more comprehensive epidemiologic research pertaining to opiate addiction in the United States (6). The particular significance of rates of readmission rests in the relationship of these differential rates to the treatment process. Thus, analysis of these data enabled us to state which patients return after treatment, how often, and after how long. We can relate the type of treatment provided and the length of hospitalization with the probability of readmission.

In the present context, rates of readmission of opiate addicts are considered as an index of the extent of relapse following treatment. Although use of this index deserves further study, it seems unlikely that any alternative index of comparable validity pertaining to a population of this size is feasible, as neither mortality nor morbidity data are available. Rather, it seems likely that these readmission rates will serve as a basis for more specialized studies of opiate addiction.

We have noted that some 40 to 50 percent of the opiate addicts admitted to Lexington during a 32-year period relapsed to abuse of drugs and returned to the hospital. The rates of readmission were markedly higher for the younger patients, and most addicts who returned did so

within 3 years of their first discharge. Most of the 43,215 addicts admitted between 1935 and 1966 were voluntary patients who left the hospital against medical advice. The rate of return of the voluntary patients was higher than that of the smaller number of Federal prisoners.

The amount of treatment which the voluntary patients received showed little relationship to the probability of readmission. Although the length of stay in the hospital was positively associated with a lower readmission rate, the difference was meager. We conclude that the treatment program for voluntary patients has had little effect in preventing readmission to the hospital for relapses to drug abuse.

Finally, it cannot be said that psychiatric treatment was ineffective for the one-half of the patient population who did not return to the hospital. Indeed, followup community studies have shown that one-third of Lexington patients eventually achieved continued abstinence from opiates, although this did not necessarily occur as a consequence of treatment (7). Still, the present research results support those followup studies which show a positive association between relapse to abuse of drugs and both the youthfulness of addicts and the inadequacy for voluntary patients of brief periods of hospital treatment.

Summary

Readmission rates for all addicts discharged from the Public Health Service Hospital, Lexington, Ky., since 1935 were calculated. During this 32-year period, 1935-66, there were 43,215 addicts treated at Lexington, and these patients had a total of 77,076 admissions. Because many patients relapsed to abuse of drugs and returned for further treatment, the recorded number of admissions is greater than the number of patients.

After admission and discharge data pertaining to all 43,215 addicts were retrieved and computerized, readmission rates were calculated by both cohort and probability methods. The second procedure was deemed preferable as it controlled for years at risk since discharge.

Of the 43,215 addicts, 70 percent were voluntary patients and 30 percent were Federal prisoners. The voluntary patients could leave the hospital at will; the Federal prisoners could not. The readmission rate for the male voluntary patients was 40.0, and the rate for the male prisoners was 36.1. Thus, voluntary patients were more likely to be rehospitalized for their addiction than the Federal prisoners. In addition, the younger addicts had higher readmission rates; among white male voluntary patients under 21 years, the rate was 52.6.

Length of hospital stay for the voluntary patients showed little relationship to the probability of readmission. The readmission rate for those addicts discharged as cured was 37.4, while the rate for those who left against medical advice before 31 days was 39.9, and the rate for those who stayed longer was 42.3.

We concluded that a positive association exists between relapse to drug abuse and both the youthfulness of addicts and the inadequacy of brief periods of voluntary hospital treatment.

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